$1.00

Simpson

INSTRUMENTS THAT STAY ACCURATE

# OPERATOR'S MANUAL

**WARNING**

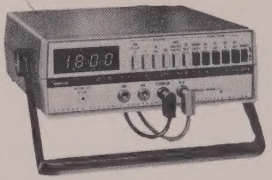
For safe usage, it is essential that the operator read this manual carefully before using the instrument for any measurements.

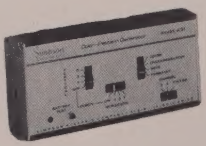
## MODEL 229 SERIES 2
## LEAKAGE CURRENT TESTER

SIMPSON ELECTRIC COMPANY

853 Dundee Ave., Elgin, Illinois 60120
Area Code 312, Telephone 697-2260
In Canada, Bach-Simpson, Ltd., London, Ontario

# NEW Simpson® TEST EQUIPMENT





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# OPERATOR'S MANUAL

## MODEL 229
## SERIES 2
## AC LEAKAGE CURRENT TESTER

SIMPSON ELECTRIC COMPANY

853 Dundee Ave., Elgin, Illinois 60120
Area Code 312, Telephone 697-2260
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Printed in U.S.A.
Rev. 4-74 NMO HINZ
5-73 NMO HINZ
Rev. 3-77 FVP

Part No. 5-115705

**Figure 1-1. Model 229 Series 2, Leakage Current Tester**

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**WARNING**

**This Instrument is designed to prevent accidental shock to the operator when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely before making any measurements. Failure to follow directions can result in a serious or fatal accident.**

**SHOCK HAZARD:** As defined in American National Standard, C39.5, Safety Requirements for Electrical & Electronic Measuring & Controlling Instrumentation, a shock hazard shall be considered to exist at any part involving a potential in excess of 30 volts rms (sine wave) or 42.4 volts DC or peak and where a leakage current from that part to ground exceeds 0.5 milliampere, when measured with an appropriate measuring instrument defined in Section 11.6.1 of ANSI C39.5.

NOTE: The proper measuring instrument for the measurement of leakage current consists essentially of a network of a 1500 ohm non-inductive resistor shunted by a 0.15 microfarad capacitor connected between the terminals of the measuring instrument. The leakage current is that portion of the current that flows through the resistor. The Simpson Model 229-Series 2 AC Leakage Current Tester meets the ANSI C39.5 requirements for the measurement of AC leakage current and can be used for this purpose. To measure DC Leakage current, connect a 1500 ohm non-inductive resistor in series with a Simpson 0-500 DC microammeter and use this as the measuring instrument.

# SECTION I

# INTRODUCTION

## 1.1 GENERAL

**1.1.1** The Simpson Model 229-2 is a special purpose AC milliameter designed specifically to measure hazardous leakage current from electrical appliances and other power line operated equipment.

**1.1.2** A three-wire grounding power cord will prevent the occurrance of a shock hazard by grounding the metal parts of the appliance; however, the grounding connection is subject to abuse and not always reliable or, in many cases, non-existant or even defeated by the user (a two wire extension cord, for example). Leakage current is therefore measured with the grounding connection open-circuited and is required to be within a specified limit for the prevention of shock.

**1.1.3** Leakage Current (as it relates to a shock hazard), is the result of resistance and capacitance between internal supply circuits and external parts accessible to an operator, which may flow through the operator's body to an earth ground and cause electric shock.

**1.1.4** Although the appliances are energized by a 60 Hz power line circuit, some may have solid-state control circuits which generate higher frequency currents and thereby possibly contribute to the leakage current. The human body, however, has a decreasing sensitivity to the sensation of electric shock as the frequency increases. The current ranges of the 229-2 are compensated to indicate a decreasing value of current with an increase in frequency in accordance with the perceptibility of the human body to shock. The meter will have a constant indication for leakage current of 60 Hz and 20 kHz for the same degree of shock.

**1.1.5** The 229-2 is intended and designed only for measuring leakage current of appliances operating from 120 or 240 power line circuits.

**1.1.6** The current ranges of the 229-2 have an insertion impedance of 1500 ohms, resistive with a parallel capacitance of 0.15$\mu$F. The meter indicates 1.1 times the average of the full-wave rectified composite wave-form of voltage across the 1500 ohm resistor. The 1500 ohm resistance simulates the resistance of the human body and the capacitance compensates the meter indication to correspond with the decreasing sensitivity of the body to shock at increasing frequency.

**1.1.7** Unlike a powerline operated instrument, the 229-2 is battery operated and completely insulated for the protection of the user.

**1.1.8** Solid-state circuitry permits a current sensitivity to be as high as 300$\mu$A full scale (minor divisions of 5$\mu$A). Two voltage ranges of 0-150VAC and 0-300VAC provide a convenient means of measuring the power-line voltage to the appliance being tested, and measuring the open circuit voltage (between the accessible parts and ground) to determine whether leakage current need be measured.

## 1.2 WHY MEASURE LEAKAGE CURRENT?

**1.2.1** The primary purpose of measuring leakage current of electrically operated equipment is to determine whether usage in a normal manner can present an electrical safety hazard to the user. Leakage current may increase with use and aging of the appliance and should be checked periodically to assure continued safety to the user of the appliance. Equipment with protective grounding through the power cord is assumed to have faulty grounding connection at the outlet when measuring leakage current. While the shock (see definition of shock hazard, page iv) in itself might be slight from the standpoint of bodily harm, the person, nevertheless might react violently out of surprise or fear, perhaps in such a way as to cause injury to himself or someone else.

**1.2.2** For a broad scope of leakage current measurements, the Simpson 229-2 covers the current measurement span from 5 microamperes to 10 milliamperes. The leakage current measurements can be made simply and dependably. The user can keep a record of potentially hazardous leakage situations, and from trends of the

data, be alerted to likely future failures. To evaluate the protection most meaningfully, one must test an electrical device or appliance in accordance with the latest applicable national standards.

## 1.3 THRESHOLD OF PERCEPTION

Leakage current limits are based on the threshold of perception. The threshold of perception is the current level at which a particular person just perceives the flow of electrical current. A mean value of perception current equal 1.067 mA @ 60 Hz was determined by tests performed on 28 men by Charles F. Dalziel (see AIEE proceedings, Volume 69, 1950, Section 0184, "Effect of Frequency on Perception Currents"). The threshold of perception of some individuals tested was considerably less than 1.067 mA at 60 Hz.

## 1.4 TECHNICAL DATA

**Table 1-1. Technical Data**

| | |
|---|---|
| 1. **FUNCTION/ RANGES:** | BATT. TEST, AC voltage (300 VAC, and 150 VAC) SHORT TEST, and AC current 10mA, 3mA, 1mA, and 0.3 mA |
| 2. **INPUT IMPEDANCE ON CURRENT RANGES:** | 1,500 ohms resistance shunted by 0.15μF. |
| 3. **INPUT RESISTANCE ON VOLTAGE RANGES:** | 500,000 ohms on the 150 VAC range and 1MΩ on the 300 VAC range. |
| 4. **ACCURACY @ 60 Hz, SINE WAVE:** | ±3% on voltage and current ranges. |
| 5. **FREQUENCY RESPONSE: (Current Ranges)** | Approximates Dalziel's Percentile 50 Threshold of Perception Curve. |
| 6. **REFERENCE CONDITIONS:** | 23°C ±1°C, 30% to 60% relative humidity. |
| 7. **POWER REQUIREMENTS:** | One 9-volt battery NEDA type 1600 (Burgess Type PM-6 or equivalent). |

| | |
|---|---|
| **8. BATTERY LIFE:** | Approximately 200 Hrs.<br>NOTE: If a longer battery life is required, a 12-volt battery NEDA Type 1810 (Burgess Type PM-8 or equiv.) can be used. Battery life will be approximately doubled (400 Hrs.). |
| **9. *RATED CIRCUIT-TO-GROUND VOLTAGE:** | 1500 volts peak. |
| **10. INSTRUMENT PROTECTION:** | The amplifier circuit and the meter are protected by signal clipping diodes at the amplifier input. |
| **11. OVERLOAD PROTECTION:** | The Instrument is capable of withstanding momentary overloads up to 500 volts peak (50/60 Hz) on all current and voltage ranges. (See 2.3f). |

*Per ANSI C39.5 April 1974 — "The specified voltage with respect to ground which may be safely and continuously applied to the circuits of an instrument."

# SECTION II

# OPERATION

## 2.1 GENERAL

**WARNING**

**The Model 229-2 is designed to prevent accidental shock when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read completely prior to making any measurements. Failure to do so can result in a serious or fatal accident.**

This section of the manual contains information required to use and operate the Model 229-2 in a safe and proper manner.

## 2.2 SAFETY PRECAUTIONS

**2.2.1** The Model 229-2 is designed to be used only by personnel qualified to recognize shock hazards and trained in the safety precautions required to avoid possible injury. Refer to SHOCK HAZARD definition on page iv.

**2.2.2** Do not work alone when making measurements where a shock hazard can exist. Notify a nearby person that you are, or intend to make such measurements.

**2.2.3** Remember, voltages might appear unexpectedly in defective equipment. An open bleeder resistor can result in a capacitor's retaining a dangerous charge. Remove all power and discharge all capacitors in the circuit being measured before making connections or disconnections.

**2.2.4** Locate all voltage sources and accessibility paths prior to making any measurements or connections.

**2.2.5** For your own safety, before each use, inspect the test leads, and connectors for cracks, breaks or crazes in the insulation. If any defects exist, destroy and replace the defective item(s) immediately.

**2.2.6** Hands, shoes, floor and workbench must be dry. Avoid making measurements under humid, damp or other environmental conditions that could affect the dielectric withstanding voltage of the test leads or the Instrument.

**2.2.7** For maximum safety, do not touch test leads, circuit, or Instrument while power is applied to the circuit being measured.

**2.2.8** Do not use test leads which differ from those originally furnished with the Instrument.

**2.2.9** Do not float any measuring terminal more that the rated circuit to ground voltage as specified in Table 1-1, item 6.

## 2.3 OPERATING INSTRUCTIONS

**WARNING**

**Do not touch the device or appliance under test with power applied until voltage and leakage current measurements have been made and found to be within applicable requirements. Obviously, during the test the requisite electrical safety has not yet been established. Therefore when going through the measurement procedure, do not touch test leads or device under test while power is applied.**

NOTE: Leakage current alone is not conclusive evidence of a shock hazard. For safe operation, the open circuit voltage between the same two points must not exceed 30 V rms.

a. Turn the function selector switch to the BATT TEST position. The pointer will deflect to the right-hand side of the dial if the battery is OK, as indicated on the lower most arc.

b. With the appropriate voltage range of the Instrument, test for proper line voltage being applied to the device under test.

c. De-energize the equipment to be tested.

d. Turn the function selector switch to the SHORT TEST position.

e. Connect Model 229-2 Leakage Current Tester, as shown in Figure 2-1.

f. Energize the equipment to be tested. If the pointer is deflected to the red area (or above) on the second arc from the bottom, **immediately** shut off power. The leakage current is greater than 10 mA and a "short" in the device is probable.

CAUTION

**The Model 229-2 will withstand 300 VAC (50/60 Hz) on short test for approximately 10 seconds.**

g. If the pointer is deflected into the green area, the leakage current may be measured more accurately by turning the selector switch clockwise until best reading is obtained.

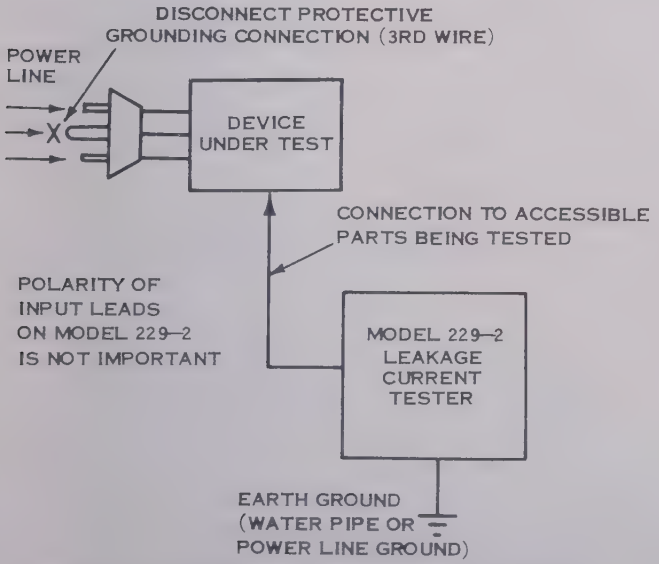


**Figure 2-1. Model 229-2, Leakage Current Testing Diagram**

h. Observe the meter reading. If the device under test has an unpolarized power plug (2 prong), reverse the plug in the socket and again note the meter reading. The highest reading obtained is the leakage current. Refer to the appropriate standard for the limitations of leakage current. As of 1976, the limit is 0.5 milliamperes (subject to change).

NOTE: Leakage current alone is not conclusive evidence of a hazard. The open circuit voltage between the same two points must be less than 30V rms.

# SECTION III

# MAINTENANCE

## 3.1 GENERAL

The Simpson 229-2 is designed and constructed with high quality components. By providing reasonable care and following the instructions in this manual the user can expect a long, useful service life from this Instrument.

## 3.2 WARRANTY

The Simpson Electric Company warranty policy is printed on the inside back cover of the manual. Read it carefully prior to requesting a warranty repair.

NOTE: For assistance of any kind, including help with the Instrument under warranty, contact the nearest Authorized Service Center listed on the last pages of this manual or contact the Factory Service Manager. Give full details of the difficulty and include the model and serial number of the unit and the date of purchase. Shipping instructions will be promptly sent to you. If an estimate of charges for non-warranty work or other service work is required, a firm quote estimate will be furnished upon receipt of the unit. Service work will not be performed without customer approval.

## 3.3 SHIPPING

Pack the Instrument carefully and ship it prepaid to the destination indicated. Insure the Instrument.

## 3.4 BATTERY REPLACEMENT

NOTE: Battery replacement is indicated whenever insufficient meter deflection occurs on BATT TEST position.

**WARNING**

**Turn off all power and remove test leads from the Instrument before removing its case.**

When battery replacement is required, the Instrument must be removed from its case. To remove the case, proceed as follows:

a. Place the Instrument face down on the soft padded surface.

b. Completely unscrew the four recessed screws located in each corner of the case.

c. Lift the case off the Instrument and set it aside.

d. Disconnect both connectors from the battery, and slide the battery out from its holder.

e. Install a new battery in the same position, with "+" to the left. See Figure 3-1. The connectors on the two ends of the battery are different; this is an additional safeguard to prevent misconnecting the battery. For longer battery life, a 12-volt Type PM-8 or equivalent can be used.

## 3.5 CALIBRATION

The single calibration adjustment in this Instrument has been set at the factory to read 8 mA on the 10 mA range, to an accuracy 10 times better than the rated accuracy of the Instrument. Unless one is knowledgeable and adequately equipped, it is unwise to upset this adjustment. If it is suspected that the Instrument is not performing within its rated accuracy, send it to your nearest Simpson Authorized Service Center for service.

## 3.6 PREVENTIVE MAINTENANCE

### 3.6.1 Daily Care

a. If something is spilled on the Instrument, immediately shut off power from the test set-up, disconnect the test leads, and wipe the Instrument clean and allow to dry. If the spillage is corrosive, use a suitable cleaner to neutralize the corrosive action, and remove the spillage.

b. Whenever the Instrument is not in use, rotate the function/range selector switch to the OFF position.

c. Whenever possible, avoid prolonged exposure or usage in areas which are subject to temperature and humidity extremes, vibration or mechanical shock, dust or corrosive fumes, or strong electrical or electromagnetic interferences.

### 3.6.2 Quarterly Care

a. Verify Instrument accuracy by performing operational checks using known accurate, stable sources. If the need for recalibration is indicated, contact your nearest Simpson Authorized Service Center (refer to last page of this manual).

b. If the Instrument has not been used for 90 days, visually check the batteries for chemical leakage and replace if necessary.

### 3.6.3 Annual Care

For critical applications, it is recommended that the Instrument be returned annually to your nearest Simpson Authorized Service Center, or the factory, for a complete over-all check, adjustment and calibration.

### 3.6.4 Storage

When the Instrument is not in use, store it in a location free from temperature extremes, dust, corrosive fumes, and mechanical vibration or shock. If storage time exceeds 90 days, remove the battery.

# SECTION IV

# ORDERING INFORMATION AND AUTHORIZED SERVICE CENTERS

## ITEMS FURNISHED WITH INSTRUMENT

| Quantity | Description | Part/Catalog Number |
|---|---|---|
| 1 | Test Lead Set — One red and one black, each 4 ft. long with combination probe tips and removable insulated alligator clips at one end and banana plugs on opposite end. | 00115 |
| 1 | 9-volt battery, NEDA Type 1600 (Burgess type PM-6 or equivalent). | 5-112598 |
| 1 | Operator's Manual | 5-115705 |

## LIST OF ACCESSORIES

| Description | Part/Catalog Number |
|---|---|
| Carrying case, black vinyl "Ever-Ready" style | 0805 |
| Carrying case, black vinyl, sheath style | 1818 |
| Carrying case, roll top, black phenolic | 0249 |
| Protective cover, black (fits over face of VOM) | 02163 |
| Flexible probe, spring loaded with retractable grip tip | 00118 |

# AUTHORIZED SERVICE CENTERS

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Tel. 918/584-4235

**OREGON, PORTLAND 97217**
□ WESTCON INC.
1910 N. Killingsworth St.
Tel. 503/285-6629

**PENNSYLVANIA, PHILADELPHIA 19115**
□ SUNSHINE SCIENTIFIC
INSTRUMENTS INC.
1810 Grant Avenue
Tel. 215/673-5600

**PENNSYLVANIA, PITTSBURGH 15222**
CAM/RPC
2801 Liberty Avenue
Tel. 412/288-2600

**PENNSYLVANIA, PITTSBURGH 15221**
□ E.I.L. INSTRUMENTS, INC.
1844 Ardmore Blvd.
Tel. 412/731-5230

**TENNESSEE, MEMPHIS 38116**
□ BROWNELL-ELECTRO INC.
3053 Tranquility Drive
Tel. 901/332-9254

**TENNESSEE, MEMPHIS 38104**
INSTRUMENT REPAIR SERVICE
1374 Overton Park Avenue
Tel. 901/278-0762

**TENNESSEE, NASHVILLE 37210**
□ BROWNELL-ELECTRO INC.
1050 Acorn Drive
Tel. 615/889-8230

**TEXAS, DALLAS 75220**
□ ULTRA INSTRUMENT LAB., INC.
9995 Monroe
Tel. 214/357-0297

**TEXAS, EL PASO 79901**
BORDER ELECTRONICS
1704 E. Paisano Drive
Tel. 915/532-2524

**TEXAS, GARLAND 75040**
METERMASTER, INC.
2809 National Drive
Tel. 214/271-5671

**TEXAS, HOUSTON 77006**
□ ELECTRICAL INSTRUMENT METER
COMPANY (EIMCO)
1424 Westheimer
Tel. 713/526-6871 & 72

**TEXAS, ODESSA 79760**
METER SERVICE & SUPPLY
2127 Kermit Highway
P.O. Box 2373
Tel. 915/332-0565

**VIRGINIA, ALEXANDRIA 22312**
□ E.I.L. INSTRUMENTS, INC.
5400 Cherokee Avenue
Tel. 703/354-4330

**VIRGINIA, RICHMOND 23229**
□ INSTRUMENT TECHNICAL
REPRESENTATIVES
1425 Blue Jay Lane
P.O. Box 4856
Tel. 804/288-7198

**WASHINGTON, SEATTLE 98105**
□ EICHER-RICHARDS COMPANY
2727 N.E. Blakeley Street
Tel. 206/523-7888

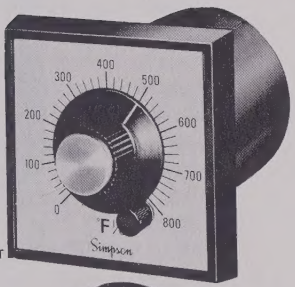
**WASHINGTON, BELLEVUE 98009**
I.L.I.
13215 S.E. 30th
P.O. Box 3097
Tel. 206/747-9410

**WASHINGTON, SPOKANE 99202**
INDUSTRIAL INSTRUMENT SUPPLY
COMPANY
N. 401 Helema
Tel. 509/534-9353

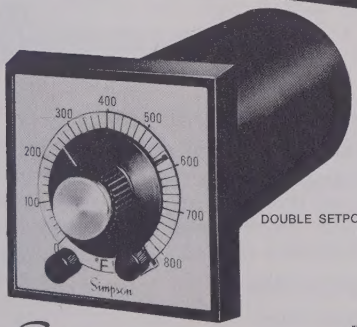
**WISCONSIN, MILWAUKEE 53202**
THE ELECTRO MECHANO COMPANY
241 East Erie Street
Tel. 414/272-4050

# NEW Simpson®

## SOLID STATE NON-INDICATING CONTROLLER MODEL 5850




SINGLE SETPOINT




DOUBLE SETPOINT

**For Precision Control of Voltage, Current and Temperature**

- **Accuracy: ±1% typical**
- **Rugged sealed, all metal housing**
- **"On-Off" control, or limit alarm with manual reset**
- **Ranges: voltage, current, temperature (thermocouple and thermistor)**
- **Solid state circuitry with 10-amp relay output**
- **Single or double setpoints**
- **Double setpoints overlap and are adjustable over 100% of scale**
- **Setpoint locks are standard**
- **Remote deviation meter output for ± 10% of F.S.**

Simpson
INSTRUMENTS THAT STAY ACCURATE

**SIMPSON ELECTRIC COMPANY**
853 Dundee Avenue, Elgin, Illinois 60120
(312) 697-2260

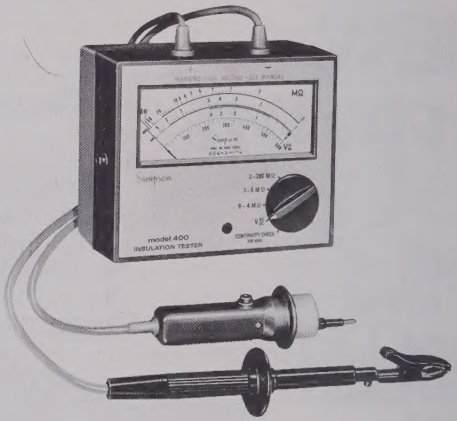
KATY INDUSTRIES
INDUSTRIAL EQUIPMENT GROUP

Simpson

# INSULATION TESTERS

## (BATTERY OPERATED)

## MODEL 400




- **Tests insulation to 500V DC**
- **Measures AC/DC voltage up to 600 V.**
- **Special "indicator" probe illuminates the measuring point, provides quick visual insulation checkout.**
- **Tests continuity in low resistance circuits.**
- **Battery-Saver push-button operation uses battery only during actual measurements.**

### SPECIFICATIONS

**Resistance ranges:**

(1) 0 to 0.4 MΩ
open circuit voltage 650 V internal resistance 0.25 MΩ

(2) 0.01 to 5 MΩ
open circuit voltage 650 V internal resistance 0.15 MΩ

(3) 2 to 200 MΩ
open circuit voltage 650 V internal resistance 0.15 MΩ

**Accuracy:** ±1.5% of F.S. Length
**Voltage range:** 0 to 600 V AC/DC
**Internal resistance:** approx 0.2 MΩ
**Continuity testing:** on-off point of lamp. approx. 500Ω
**Supply:** rated voltage 9 V (six 1.5 V batteries)
**Test voltage:** 2 kV RMS
**Dimensions:** 5.6" x 4.6" x 3.2" (141 x 117 x 80 mm)
**Weight:** 3 lbs. (1.4 kg)

Plug-in probe and clip (interchangeable with plug-in alligator clip), red insulated with banana connections, Cat. #00737

# WARRANTY

SIMPSON ELECTRIC COMPANY warrants each instrument and other articles of equipment manufactured by it to be free from defects in material and workmanship under normal use and service, its obligation under this warranty being limited to making good at its factory any instrument or other article of equipment which shall within 90 days after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any instrument or other article of equipment which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

Simpson
INSTRUMENTS THAT STAY ACCURATE

**ELECTRIC COMPANY**
853 Dundee Ave., Elgin, Illinois 60120 Phone: (312) 697-2260
**IN CANADA:** Bach-Simpson, Ltd., London, Ontario
**IN ENGLAND:** Back-Simpson (U.K.) Limited, Wadebridge, Cornwall
**IN INDIA:** Ruttonsha-Simpson Private, Ltd., International House
Bombay-Agra Road, Vikhroli, Bombay

KATY INDUSTRIES
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EQUIPMENT
GROUP

Quality is the indispensable component of every Simpson instrument . . . . . .